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System Logic Description for the Low-Activity Waste Facility – LAW Primary Offgas Process (LOP) System

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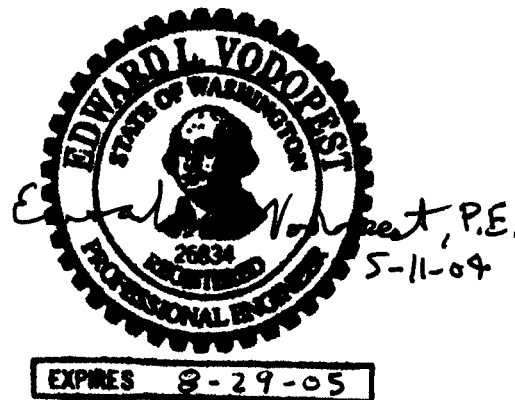
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History Sheet

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Glossary

Acquire	A command, under batch control, that reserves a group of equipment for that particular batch control.
Actual Volume	Volume of waste/process fluid in any vessel in gallons.
Available Space	Volume of waste/process fluid that any vessel can accommodate and still be lower than the upper operating limit (UOL), in gallons. Available space can be calculated as follows: <i>Available Space = UOL - Actual Volume</i> .
Available Volume	Volume of waste/process fluid that any vessel can transfer to another vessel and still be above the lower operating limit (LOL), in gallons. Available volume can be calculated as follows: <i>Available Volume = Actual Volume - LOL</i> .
Batch	The material that is being produced or that has been produced by a single execution of a batch process.
Batch Control	Control activities and control functions that provide a means to process (that is, an ordered set of processing activities) finite quantities of material over a finite period of time using one or more pieces of equipment.
Batch Process	A process that leads to the production of finite quantities of material by subjecting quantities of input material to an ordered set of processing activities over a finite period of time using one or more pieces of equipment.
Exception Handling	Those functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
Permissive	Interlock that allows a device to change state or a sequence to start. Once a device has changed state or a sequence has started, permissives have no further effect on the device or sequence.
Release	A command under a batch control that opens up a group of equipment for any batch control to acquire.
Trip	Interlock that does not allow a device to change state or a sequence to start. Once a device has changed state or a sequence has started, trips continue to have an effect on the device or sequence.

Acronyms and Abbreviations

AEA	Atomic Energy Act of 1954
DOE	US Department of Energy
LAHH	level alarm high high
LALL	level alarm low low
LAW	low-activity waste
LI	level indicator
LOP	LAW primary offgas system
LSHH	level switch high high
LSLL	level switch low low
LT	level transmitter
LY	level relay
PCJ	process control system
PPJ	programmable protection system
RLD	radioactive liquid waste disposal system
SBS	submerged bed scrubber
WESP	wet electrostatic precipitator

1 Introduction

This document describes the instrument control logic for regulated plant items and associated ancillary equipment within the low-activity waste (LAW) facility for the LAW primary offgas (LOP) system associated with dangerous waste management. This document focuses on tank and ancillary equipment for the LOP system above the 0 ft elevation within the LAW facility.

2 Applicable Documents

WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code, as amended.

3 Description

The plant items and ancillary equipment associated with dangerous waste management in the LAW system and the LOP system consists of the following:

- | | |
|-------------------|-------------------------------------|
| • LOP-BULGE-00001 | Melter 1 Valve Bulge |
| • LOP-BULGE-00002 | Melter 2 Valve Bulge |
| • LOP-FCLR-00001 | Melter 1 Primary Offgas Film Cooler |
| • LOP-FCLR-00002 | Melter 1 Standby Offgas Film Cooler |
| • LOP-FCLR-00003 | Melter 2 Primary Offgas Film Cooler |
| • LOP-FCLR-00004 | Melter 2 Standby Offgas Film Cooler |
| • LOP-SCB-00001 | Melter 1 SBS |
| • LOP-SCB-00002 | Melter 2 SBS |
| • LOP-VSL-00001 | Melter 1 SBS Condensate Vessel |
| • LOP-VSL-00002 | Melter 2 SBS Condensate Vessel |
| • LOP-WESP-00001 | Melter 1 WESP |
| • LOP-WESP-00002 | Melter 2 WESP |

3.1 Melter 1 Submerged Bed Scrubber LOP-SCB-00001 and Melter 1 SBS Condensate Vessel LOP-VSL-00001

The melter 1 submerged bed scrubber (SBS) (LOP-SCB-00001) is at the 2 ft elevation in an enclosed wet process C5 cell, room L-0123. Offgas passes from the melter to the melter 1 primary offgas film cooler (LOP-FCLR-00001) or melter 1 standby offgas film cooler (LOP-FCLR-00002) to the melter 1 SBS (LOP-SCB-00001) for aqueous scrubbing of entrained radioactive particulate from melter offgas plus cooling and condensation of melter vapor emissions. Melter 1 SBS (LOP-SCB-00001) is constructed of alloy C-22.

The scrubbed offgas discharges through the top of the SBS, through a series of equipment to a process stack. As the offgas cools, water vapor condenses and increases the liquid inventory in the SBS. A constant liquid depth is maintained in the melter 1 SBS (LOP-SCB-00001) as excess liquid overflows into the melter 1 SBS condensate vessel (LOP-VSL-00001), also at the 2 ft elevation in the enclosed wet

process C5 cell, room L-0123. Melter 1 SBS (LOP-SCB-00001) level is continuously monitored by redundant level transmitters LOP-LT-1011 and LOP-LT-1063. Melter 1 SBS water purge pump, primary/standby (LOP-PMP-00003A/3B) for the SBS, transfers condensate to the SBS condensate collection vessel (RLD-VSL-00005) at the 2 ft elevation in an enclosed effluent C5 cell, room L-0126.

Liquid from the melter 1 SBS condensate vessel (LOP-VSL-00001) is recycled to the SBS at a rate higher than condensate is removed. The melter 1 SBS condensate vessel (LOP-VSL-00001) is constructed of alloy C-22. The melter 1 SBS condensate vessel (LOP-VSL-00001) is vented back to the melter 1 SBS (LOP-SCB-00001). Melter 1 SBS condensate vessel (LOP-VSL-00001) level is continuously monitored by level transmitter LOP-LT-1018. To help remove solids, the melter 1 SBS condensate purge pumps (LOP-PMP-00001/2) recirculate condensate through lances that agitate the bottom of the SBS and consolidate the solids near the pump suction. To suspend the solids in the melter 1 SBS condensate vessel (LOP-VSL-00001), the melter 1 SBS condensate mixing eductor (LOP-EDUC-00001) is used, using a side stream from the recirculation line.

For the melter 1 SBS (LOP-SCB-00001) at a predetermined setpoint, the programmable protection system (PPJ) notifies the operator via the process control system (PCJ) that liquid level has risen to a point where purge is required. The operator then selects the target vessel and initiates the transfer sequence. Once initiated, the PCJ verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. At high-high level setpoint, the PCJ system initiates a critical alarm and alerts the operator. The transfer will end when either the level in the melter 1 SBS (LOP-SCB-00001) reaches its low-level control point, or the selected target vessel reaches its high-level control point, or sooner as determined by the operator. Figure 1 depicts the instrumentation associated with the melter 1 SBS (LOP-SCB-00001).

For the melter 1 SBS condensate vessel (LOP-VSL-00001), the PCJ system alarms at high-level setpoint, and alerts the operator. Figure 2 depicts the instrumentation associated with the melter 1 SBS condensate vessel (LOP-VSL-00001).

3.2 Melter 1 Valve Bulge LOP-BULGE-00001

The melter 1 valve bulge (LOP-BULGE-00001) is at the 28 ft elevation in the process cell charge floor C3 area, room L-0202. The melter 1 valve bulge (LOP-BULGE-00001) is connected by through-floor piping back down to the melter 1 SBS (LOP-SCB-00001), SBS condensate collection vessel (RLD-VSL-00005), and melter 1 SBS condensate vessel (LOP-VSL-00001).

The melter 1 SBS (LOP-SCB-00001) is connected to the melter 1 SBS water purge pumps -primary/standby (LOP-PMP-00003A/3B) at a platform at approximately 14 ft elevation, also in the enclosed wet process C5 cell, room L-0123, connected by through-wall piping to the melter 1 valve bulge (LOP-BULGE-00001), which is connected to the SBS condensate collection vessel (RLD-VSL-00005).

The melter 1 SBS condensate vessel (LOP-VSL-00001) is connected by through-wall piping to the melter 1 valve bulge (LOP-BULGE-00001), which sidestreams to melter 1 SBS (LOP-SCB-00001) or simply recirculates back to melter 1 SBS condensate vessel (LOP-VSL-00001).

During off-normal operation, any bulge drain volume contents will overflow via through-floor piping into the L-0123 process cell waste disposal west sump (RLD-SUMP-00029), at the 2 ft elevation in the enclosed effluent cell, room L-0123.

3.3 Melter 1 Wet Electrostatic Precipitator LOP-WESP-00001

The melter 1 wet electrostatic precipitator (WESP) (LOP-WESP-00001) is at the 2 ft elevation in an enclosed wet process C5 cell, room L-0123. The melter 1 WESP (LOP-WESP-00001) is constructed of 6 % molybdenum stainless steel. After initial aerosol and soluble gas removal in the SBS, the cooled offgas is routed to the melter 1 WESP (LOP-WESP-00001) for further removal of aerosols. The saturated gas flows upward through the tubes of the WESP. The inlet is also provided with an inlet misting to enhance rundown and cleaning. The condensate then gravity drains into the C3/C5 drains/sump collection vessel (RLD-VSL-00004). At high-high level setpoint, the PCJ system initiates a critical alarm and alerts the operator. Figure 3 depicts the instrumentation associated with the melter 1 WESP (LOP-WESP-00001).

3.4 Melter 2 SBS LOP-SCB-00002 and Melter 2 SBS Condensate Vessel LOP-VSL-00002

The melter 2 SBS (LOP-SCB-00001) is at the 2 ft elevation in an enclosed wet process C5 cell, room L-0124. Offgas passes from the melter to the melter 2 primary offgas film cooler (LOP-FCLR-00003) or melter 2 standby offgas film cooler (LOP-FCLR-00004) to the melter 2 SBS (LOP-SCB-00002) for aqueous scrubbing of entrained radioactive particulate from melter offgas plus cooling and condensation of melter vapor emissions. The melter 2 SBS (LOP-SCB-00002) is constructed of alloy C-22.

The scrubbed offgas discharges through the top of the SBS, through a series of equipment to a process stack. As the offgas cools, water vapor condenses and increases the liquid inventory. A constant liquid depth is maintained in the melter 2 SBS (LOP-SCB-00002) as excess liquid overflows into the melter 2 SBS condensate vessel (LOP-VSL-00002), also at the 2 ft elevation in the enclosed wet process C5 cell, room L-0124. The melter 2 SBS (LOP-SCB-00002) level is continuously monitored by redundant level transmitters LOP-LT-2011 and LOP-LT-2063. The melter 2 SBS water purge pump - primary (LOP-PMP-00006A) for the SBS transfers condensate to the SBS condensate collection vessel (RLD-VSL-00005) at the 2 ft elevation in an enclosed effluent C5 cell, room L-0126.

Liquid from the melter 2 SBS condensate vessel (LOP-VSL-00002) is recycled to the SBS at a rate higher than condensate is removed. The melter 2 SBS condensate vessel (LOP-VSL-00002) is constructed of alloy C-22. The melter 2 SBS condensate vessel (LOP-VSL-00002) level is continuously monitored by level transmitter LOP-LT-2018. To help remove solids, the melter 2 SBS condensate purge pumps (LOP-PMP-00003/4) recirculate condensate through lances that agitate the bottom of the SBS and consolidate the solids near the pump suction. To suspend the solids in the melter 2 SBS condensate vessel (LOP-VSL-00002), the melter 2 SBS condensate mixing eductor (LOP-EDUC-00002) is used, using a side stream from the recirculation line.

For the melter 2 SBS (LOP-SCB-00002) at a predetermined setpoint, the PPJ notifies the operator via the PCJ that liquid level has risen to a point where purge is required. The operator then selects the target vessel and initiates the transfer sequence. Once initiated, the PCJ verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. At high-high level setpoint, the PCJ system initiates a critical alarm and alerts the operator. The transfer will end when either the level in the melter 2 SBS (LOP-SCB-00002) reaches its low-level control point or the selected target vessel reaches its high-level control point. Figure 4 depicts the instrumentation associated with the melter 2 SBS (LOP-SCB-00002).

For the melter 2 SBS condensate vessel (LOP-VSL-00002), the PCJ system alarms at high-level setpoint, and alerts the operator. Figure 5 depicts the instrumentation associated with the melter 2 SBS condensate vessel (LOP-VSL-00002).

3.5 Melter 2 Valve Bulge LOP-BULGE-00002

The melter 2 valve bulge (LOP-BULGE-00002) is at the 28 ft elevation in the process cell charge floor C3 area, room L-0202. The melter 2 valve bulge (LOP-BULGE-00002) is connected by through-floor piping back down to melter 2 SBS (LOP-SCB-00002), SBS condensate collection vessel (RLD-VSL-00005), and melter 2 SBS condensate vessel (LOP-VSL-00002).

The melter 2 SBS (LOP-SCB-00002) is connected to the melter 2 SBS water purge pumps -primary/standby (LOP-PMP-00006A/6B) at a platform at approximately 14 ft elevation, also in the enclosed wet process C5 cell, room L-0124, which is connected by through-wall piping to the melter 2 valve bulge (LOP-BULGE-00002), which is connected to the SBS condensate collection vessel (RLD-VSL-00005).

The melter 2 SBS condensate vessel (LOP-VSL-00002) is connected by through-wall piping to the melter 2 valve bulge (LOP-BULGE-00002), which sidestreams to melter 2 SBS (LOP-SCB-00002) or simply recirculates back to melter 2 SBS condensate vessel (LOP-VSL-00002).

During off-normal operation, any bulge drain volume contents will overflow via through-floor piping into the L-0124 process cell waste disposal west sump (RLD-SUMP-00031), at the 2 ft elevation in the enclosed effluent cell, room L-0124.

3.6 Melter 2 Wet Electrostatic Precipitator LOP-WESP-00002

The melter 2 WESP (LOP-WESP-00002) is at the 2 ft elevation in an enclosed wet process C5 cell, room L-0124. The melter 2 WESP (LOP-WESP-00002) is constructed of 6 % molybdenum stainless steel. After initial aerosol and soluble gas removal in the SBS, the cooled offgas is routed to the melter 2 WESP (LOP-WESP-00002) for further removal of aerosols. The saturated gas flows upward through the tubes of the WESP. The inlet is also provided with an inlet misting to enhance rundown and cleaning. The condensate then gravity drains into the C3/C5 drains/sump collection vessel (RLD-VSL-00004). Figure 6 depicts the instrumentation associated with the melter 2 WESP (LOP-WESP-00002).

Figure 1 LOP-LT-1011Z and LOP-LT-1063Z for LOP-SCB-00001

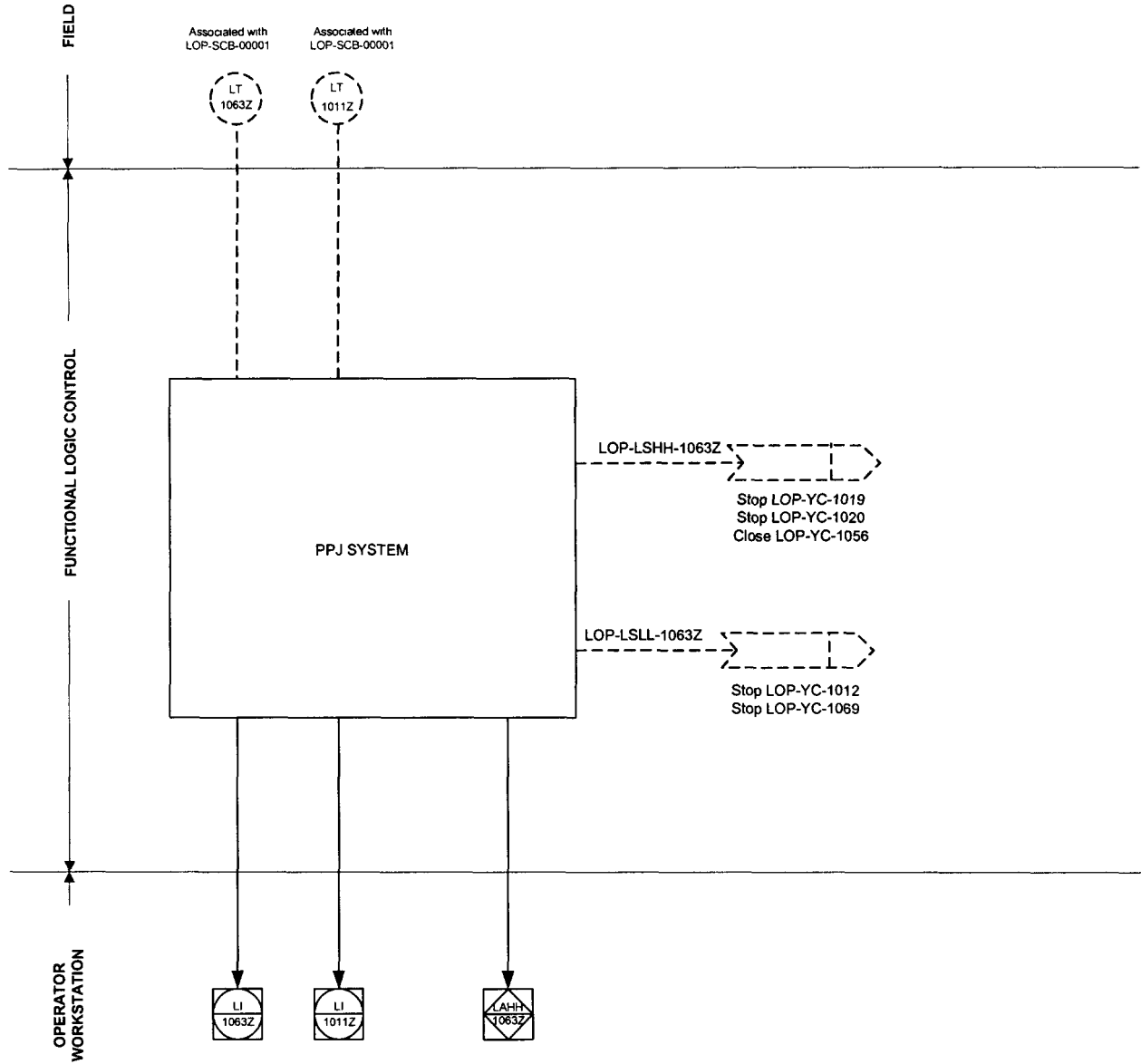


Figure 2 LOP-LT-1018 for LOP-VSL-00001

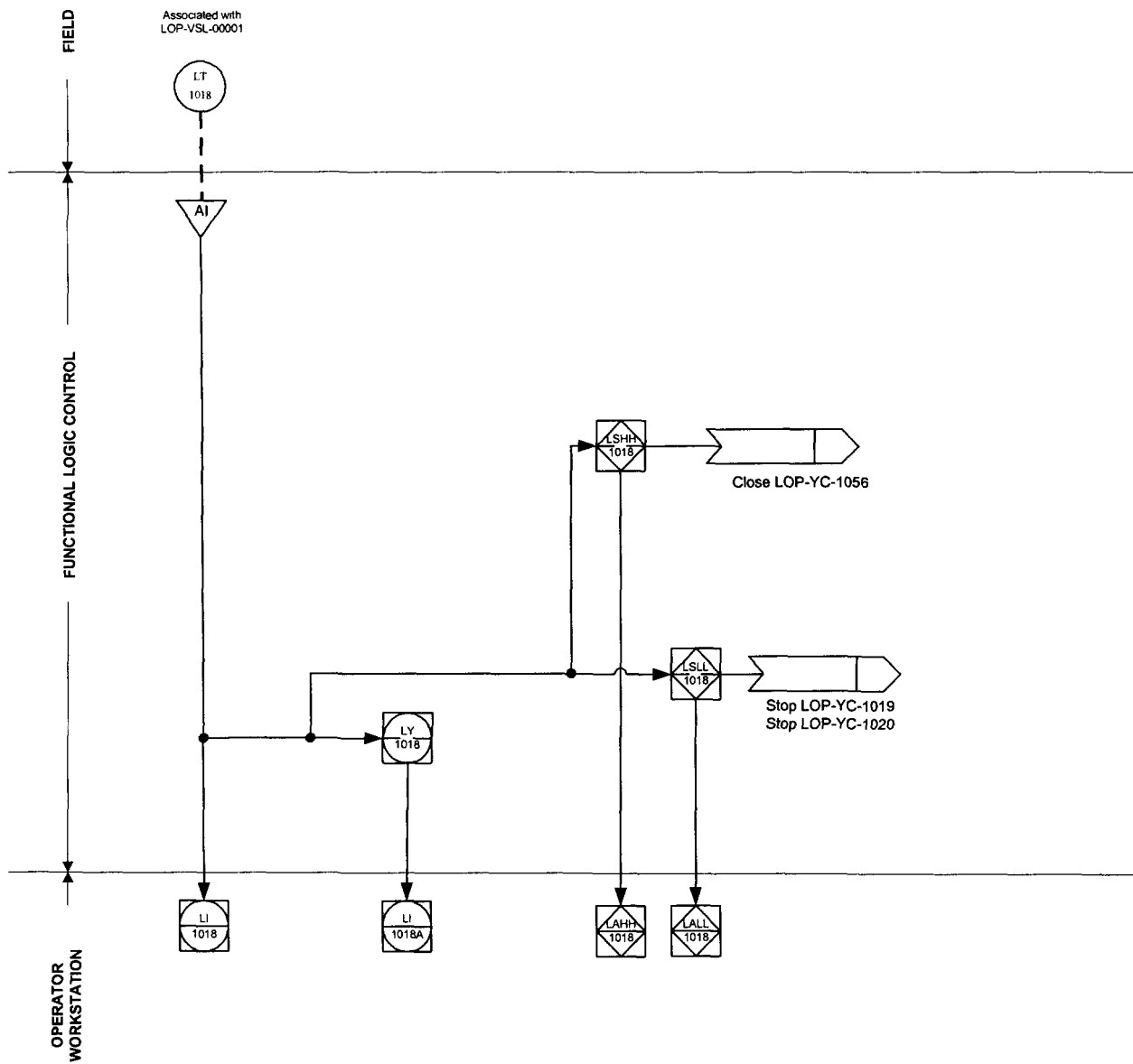


Figure 3 LOP-LT-1059Z and LOP-LT-1060Z for LOP-WESP-00001

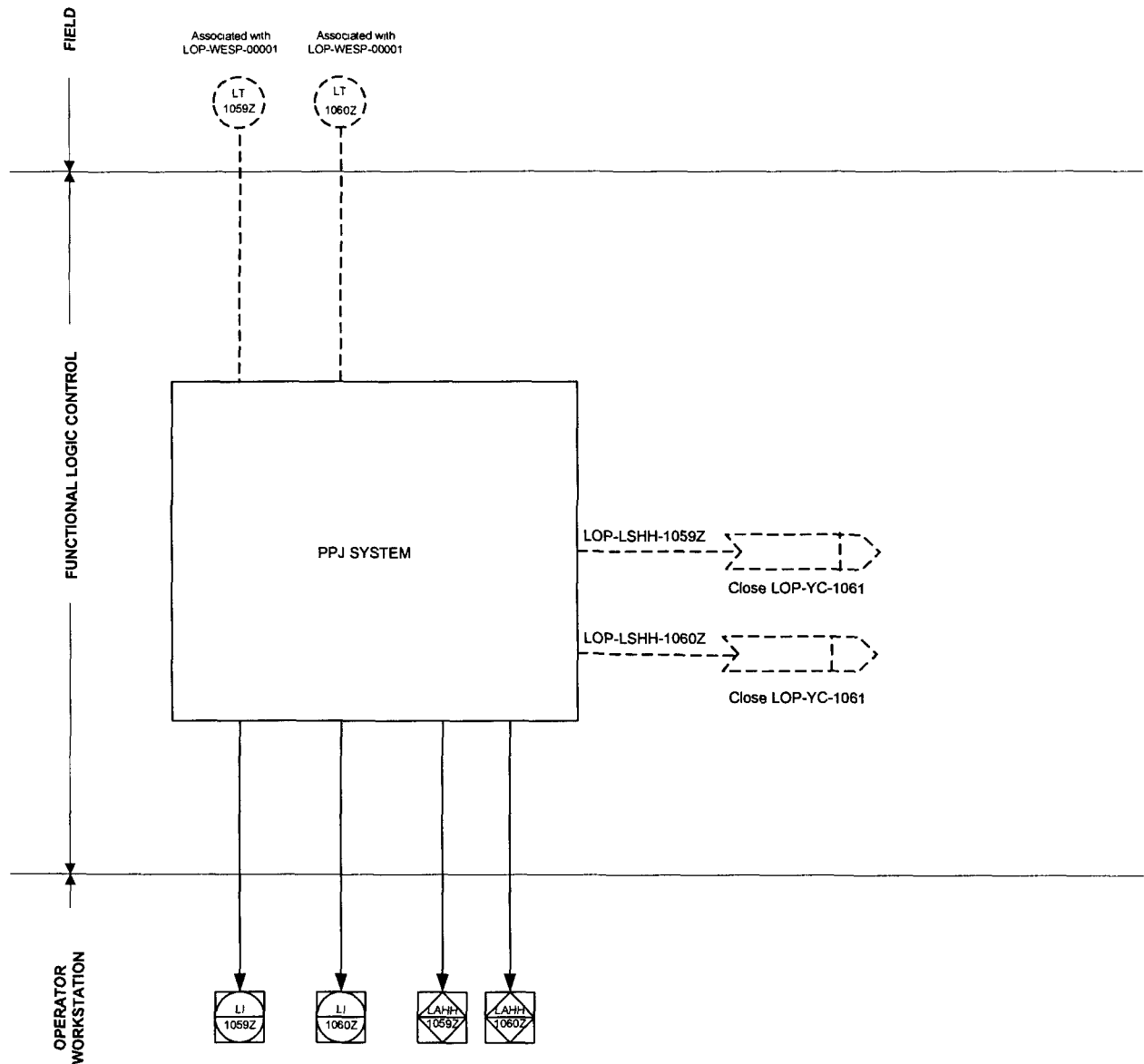


Figure 4 LOP-LT-2011Z and LOP-LT-2063Z for LOP-SCB-00002

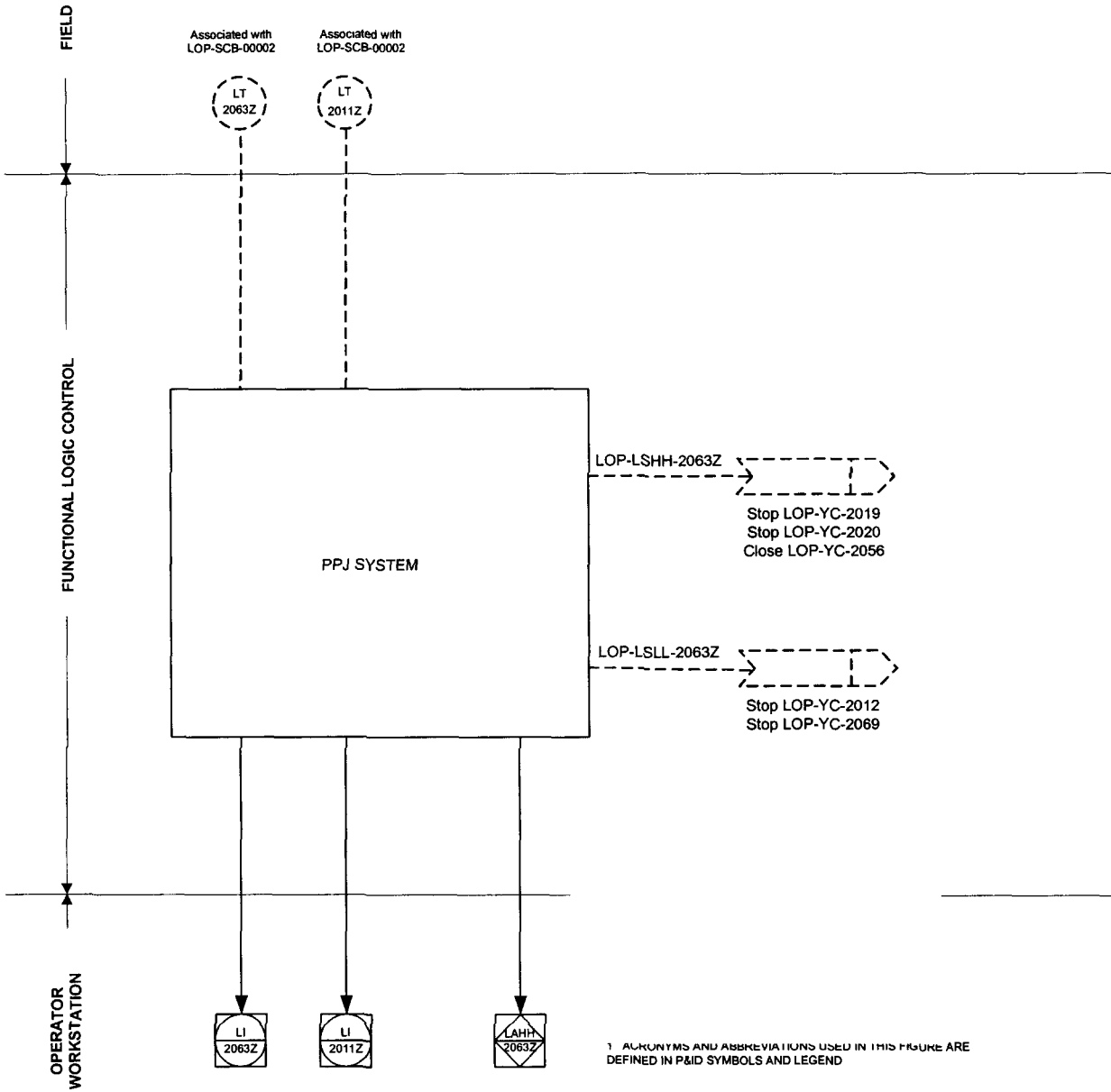


Figure 5 LOP-LT-2018 for LOP-VSL-00002

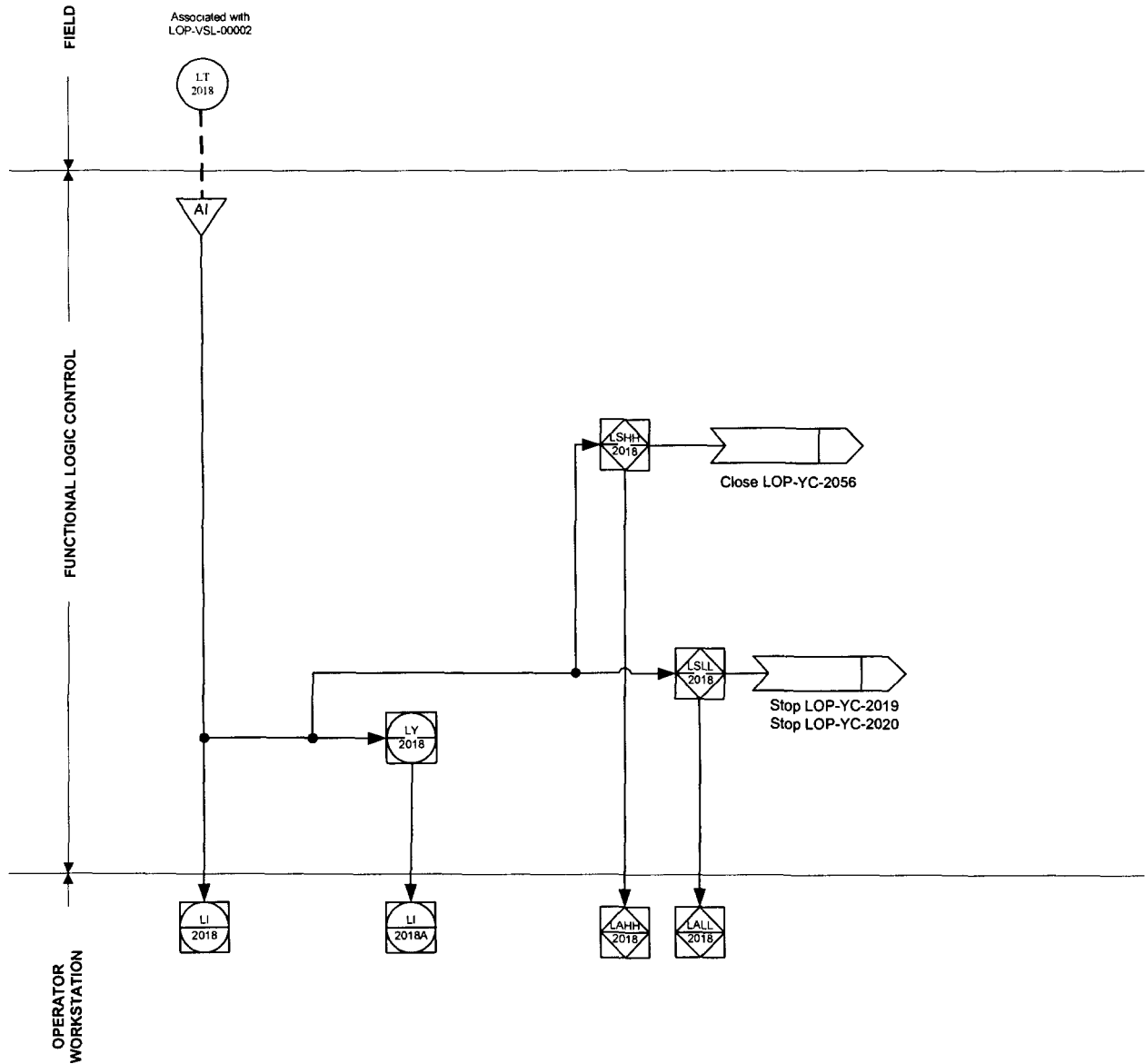


Figure 6 LOP-LT-2059Z and LOP-LT-2060Z for LOP-WESP-00002

